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# DISEASES OF SHEEP



**I**NFECTIONOUS and noninfectious diseases and common ailments of sheep in America are considered in this bulletin. It does not deal with diseases caused by animal parasites, such as gid, grub in the head, stomach, lung, and intestinal-worm affections, liver rot, scabies, etc., nor with plant poisoning. These diseases are described in other publications of the Department of Agriculture.

The aim has been to give only the more important or characteristic symptoms which would be of value in distinguishing one disease from another.

Sheep owners are reminded that a disease does not always display identical symptoms in each animal, and also that certain general symptoms may be present in a number of diseases. Hence in important cases it is advisable to call in a veterinarian, if one is available, rather than trust too much to one's own powers of observation.

Methods of treatment are outlined with regard to ease of application and the use of remedies which are both effective and easily procured.

Much may be done to prevent disease and to keep sheep in a healthy condition by proper care, feeding, and sanitation. Information as to disinfection and disinfectants may be found in Farmers' Bulletins 926 and 954.

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Washington, D. C.

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# DISEASES OF SHEEP

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## CONTENTS

	Page		Page
Infectious diseases			
Anthrax (charbon)	1	Diseases of the digestive system	21
Blackleg (quarter ill)	3	Defective teeth	21
Malignant edema (gas gangrene)	3	Dropping the cud	21
Hemorrhagic septicemia (cattarhal fever)	4	Stomatitis	21
Tetanus (lockjaw)	5	Choking	22
Lip-and-leg ulceration (necrobacillosis)	6	Indigestion	22
Noncontagious foot rot (canker of foot)	8	Bloating (hoven)	22
Necrobacillosis of the navels of lambs	8	Gastroenteritis (inflammation of stomach and intestines)	23
White scours of lambs (infectious diarrhea)	9	Colic	23
Joint ill of lambs (navel ill)	9	Diarrhea (dysentery)	23
Caseous lymphadenitis (cheesy bronchopneumonia)	11	Constipation	24
Tuberculosis (consumption)	11	Retention of the meconium	24
Rabies (hydrophobia)	12	Diseases of the nervous system	24
Foot-and-mouth disease (aphthous fever)	12	Meningitis	24
Sheep pox (variola ovina)	13	Paralysis	25
Actinomycosis (lumpy jaw)	14	Diseases of the urinary system	25
General diseases		Bloody urine (hematuria)	25
Jaundice (yellow)	14	Uremia	25
Icterohematuria (red water)	14	Gravel (urinary calculi)	25
Peritonitis	15	Diseases of the reproductive system	26
Ascites (water belly)	15	Abortion	26
Anemia	15	Death of fetus in womb	26
Rickets (leg weakness)	16	Eversion of uterus and vagina	26
Goiter (big neck)	16	Dystocia (difficult lambing)	27
Rheumatism	16	Metritis (inflammation of the womb)	27
Wool eating	17	Preparturient paralysis (before-lambing paralysis)	27
Diseases of the head and air passages		Milk fever of ewes (after-lambing paralysis)	28
Bighead	17	Mammitis (blue bag)	28
Sore eyes (conjunctivitis)	17	Reviving chilled lambs	29
Nasal catarrh (snuffles)	19	Diseases of the skin	29
Bronchitis	20	Eczema (rain rot)	29
Pneumonia (lung fever)	20	Ringworm	29
"Lunger disease"	20	Puckwheat rash (fagopyrism)	30
		Dandruff (false scab)	30
		Baldness (alopecia)	30

## INFECTIOUS DISEASES

### ANTHRAX

(Charbon, splenetic fever, malignant pustule, woolsorter's disease)

**A**NTHRAX is a rapidly fatal, infectious febrile disease. In sheep it usually takes the acute form, but may be subacute.

**Cause.**—The disease is caused by the *Bacillus anthracis*, an organism of microscopic size.

Anthrax is contracted through feeding, through wounds exposed to infected soil, and through the contamination of wounds by flies which have fed on carcasses of animals that have died of anthrax or on discharges from diseased animals.

**Symptoms.**—In sheep the disease usually runs a rapid course, especially in the first animals affected. Apparently healthy animals sud-

<sup>1</sup> Doctor Gallagher resigned Mar. 5, 1924. Slightly revised by H. W. Schoening, Chief, Pathological Division.

denly develop weakness of the legs and difficult breathing. They fall to the ground, move convulsively, and may die in a few minutes or within an hour. Where death is less sudden, periods of stupor alternate with convulsions, the mucous membranes of the nostrils and mouth become bluish, the temperature is highly elevated, and bloody discharges may issue from the mouth, nostrils, or anus.

**Post-mortem appearance.**—The carcass decomposes and bloats rapidly. Bloody, frothy discharges are found around the natural openings of the body. Yellow, jellylike deposits and hemorrhagic areas are present beneath the skin. The blood does not clot and is tarlike in appearance. The spleen is greatly enlarged, its pulp softened or fluid and dark red or chocolate in color. The intestines and other internal organs are congested or hemorrhagic. The intestinal contents are bloody and the urine may be bloodstained; bloodstained fluid is found in the abdominal and lung cavities. Yellowish, jellylike deposits are observed beneath the serous membranes of the organs. The lungs show congestion and fluid infiltration.

**Diagnosis.**—Anthrax is distinguished from other diseases of sheep by the greatly enlarged, dark-colored, softened spleen; the uncoagulated, tarry blood; the jellylike deposits beneath the skin and in the viscera, and by the hemorrhagic condition of the intestines. In hemorrhagic septicemia, which most closely resembles anthrax in sheep, the spleen is not enlarged and the blood is normal in color.

**Treatment.**—Medicinal treatment has no value in anthrax. The hypodermic injection of antianthrax serum is an effective treatment in the case of animals which show a rise of temperature but which have not yet developed visible symptoms, or in mild chronic cases.

The exposed members of the flock which do not show abnormal temperatures (above 104° F.) should be immunized by the simultaneous method, which consists in the injection of a spore vaccine and antianthrax serum at the same time. Biological firms dealing in antianthrax serum and vaccine specify the proper doses of their products. Whenever possible, vaccination should be conducted by a veterinarian.

Affected flocks should be removed from anthrax-infected ground as soon as possible, even though immunity measures are being instituted, in order to lessen the exposure to gross infection. Care should be taken that public roads or adjacent premises are not exposed to contamination by infected flocks.

**Prevention.**—On anthrax-infected farms the wisest course is to vaccinate annually, as immunity can not be depended upon to last for a longer period than one year. Flocks outside of anthrax-infected localities should not be injected with living antianthrax products, because of the danger of establishing new anthrax centers.

Sheep are very susceptible to anthrax inoculation; hence care should be taken that an overdose of either the spore or Pasteur vaccines is not given. The dose should not be greater than one-sixth of the dose for cattle.

To guard against infection of the soil all carcasses and animal discharges should be destroyed by burning or by burying deep and covering with quicklime. Animals should not be skinned or cut open except for diagnostic purposes. Great care should be taken in handling animals affected with anthrax, as man is susceptible to the disease. Buzzards and dogs may easily carry infected material. Infected land should be quarantined or fenced in. Drainage and

cultivation of the soil will eliminate the danger to a great extent. Small streams which drain infected areas or into which carcasses of animals which have died from anthrax have been thrown may infect pastures downstream.

**BLACKLEG**

(Quarter ill, black quarter, emphysematous anthrax)

Blackleg is an infectious disease which is confined to certain areas where the soil is infected with the blackleg organism.

**Cause.**—The disease is caused by *Clostridium chauvai*. Infection is introduced through minute punctures of the skin by thorns, spines, or burs.

**Symptoms.**—A swelling appears under the skin on any part of the body except below the knee or hock joint. It frequently appears on either the hind quarter or shoulder and often on the face, jaws, neck, or breast. Several of these tumors may form simultaneously. They increase rapidly in size and in a few hours may cover a large surface. Pressure on the swelling may produce a crackling sound, due to the presence of gas in the tissue. The wool in some cases is shed over the affected part. Lameness or stiffness is usually evident. If the tumor is lanced, a frothy, dark-red fluid is discharged. The formation of the tumor is accompanied with general symptoms consisting of high fever, increased respiration, suspension of rumination, and great depression. The disease nearly always terminates fatally in a few hours after symptoms are apparent.

**Post-mortem appearance.**—The affected muscles are dark red or black, soft, and infiltrated with bloody liquid and gas bubbles. They have the odor of rancid butter. The internal organs, as a rule, do not show marked changes, and the blood, except in the diseased areas, appears normal and clots readily.

**Diagnosis.**—Blackleg swellings are distinguished from anthrax swellings by their soft, gaseous condition and deep muscular involvement. Anthrax swellings are hard and do not have the peculiar sweetish-sour odor of blackleg. In blackleg the spleen is unchanged and the blood clots readily. Malignant edema swellings are quite similar to blackleg swellings and also contain gas. They arise from larger wounds or surgical operations and may follow careless castration, docking, or shearing.

**Treatment.**—Animals may be protected against blackleg by the injection of blackleg vaccine specially prepared for sheep. Medicinal treatment is unsuccessful.

**MALIGNANT EDEMA**

(Gas gangrene)

Malignant edema is an acute febrile disease caused by a wound becoming infected. It is manifested by gangrenous swelling at the point of infection. It occurs after castration, shearing, docking, or in connection with injuries.

**Cause.**—The organism, *Clostridium edematis*, which causes the disease, is found almost everywhere in the soil.

**Symptoms.**—Several hours after castration, shearing, or docking, and when infection with the organism occurs, a swelling develops around the wound and spreads beneath the skin. Gas forms and a

clear or reddish fluid containing gas bubbles issues from the wound. The animal's temperature usually is from 106° to 108° F. Respiration is rapid and diarrhea is frequently present. When the animal moves, the hind legs are drawn forward with a peculiar, stiff, dragging motion, as if there were no joints.

**Post-mortem appearance.**—On removal of the skin the region between the hind legs and underneath the tail is found to be gangrenous and contains a dark-colored fluid and gas, or this condition may be found on other parts of the body, depending upon the seat of the infected wound. No characteristic changes are found in the internal organs.

**Diagnosis.**—Diagnosis rests on the appearance of a spreading, gangrenous, gaseous swelling at the seat of operation after castration or docking or around a wound made in shearing.

**Treatment.**—Medicinal treatment is useless. Disinfection of wounds or areas of operation prevents infection. Instruments used in operating should be sterilized before using. Sheep and lambs, after operation, should be placed for a time in lots or barns which have been cleaned and disinfected.

#### HEMORRHAGIC SEPTICEMIA

(Catarrhal fever, pneumoenteritis)

Hemorrhagic septicemia is an infectious, febrile disease. It occurs in both the acute and chronic forms. Lambs are affected mostly by the acute form, grown sheep by the chronic form. Death may ensue several hours after illness is noticed, or within two or three days. The chronic form may continue for several weeks.

**Cause.**—A germ known as *Pasteurella oviseptica* is the cause of the disease (fig. 1). This organism may live in the air passages of normal sheep without producing harmful results. Under certain conditions, however, such as exposure to sudden adverse atmospheric changes or to hardships in shipping, the resistance of the body may be diminished to such an extent that the organism becomes active and starts severe outbreaks of hemorrhagic septicemia. The organism may also become active when animals are suffering from other diseases. When virulence is attained the disease may spread from animal to animal by means of infected feed or water.

**Symptoms.**—In the acute form, dullness, weakness, and a general constitutional disturbance are first noticed. The appetite is lost, thirst increased, and the temperature raised. Symptoms of pneumonia are manifested by difficult breathing and coughing. A serous or purulent discharge may pass from the nose and also from the eyes. There may be colicky pains. Diarrhea sets in, the excrement being dark or greenish yellow and fetid. Suckling lambs and lambs at weaning time are rapidly overcome. Severe outbreaks of hemorrhagic septicemia may be seen in mature sheep, but as a rule the latter are more resistant.

The chronic form is indicated when animals are less severely attacked or have survived an acute attack and suffered from a chronic affection of the lungs. A panting respiration, frequent cough, and a mucopurulent discharge from the nose and sometimes from the eyes are present. The body becomes thinner. There is stiffness and sometimes swelling of the joints, especially of the knee joints.

**Post-mortem appearance.**—Except in the very acute form the lungs show evidence of pneumonia. The heart frequently has hemorrhagic spots on its surface. The internal lining of the fourth stomach and intestines is congested and shows hemorrhagic spots. A watery or fibrinous discharge is found in the abdominal and lung cavities. The spleen, liver, kidneys, and lymphatic glands are congested or hemorrhagic in spots.

**Diagnosis.**—Hemorrhagic septicemia is distinguished from anthrax by the absence of a greatly enlarged, discolored, softened spleen, and by the fact that the blood usually appears normal and also clots in hemorrhagic septicemia.

**Treatment.**—There is no successful treatment known for sheep or lambs suffering from acute hemorrhagic septicemia. The sick animals should be isolated and the flock moved to new ground. Stables should be cleaned and disinfected frequently. Antihemorrhagic-septicemia serum and vaccine are used with considerable success in immunizing exposed sheep.

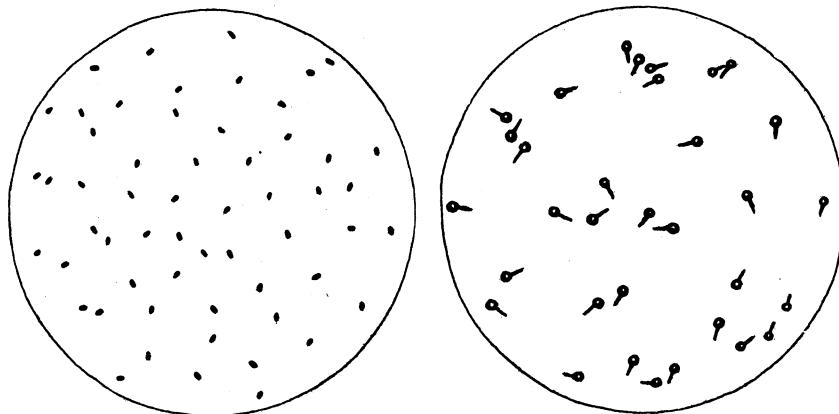


FIG. 1.—Types of microorganisms causing infectious diseases of sheep. Left, *Pasteurella oviseptica*, cause of hemorrhagic septicemia. Right, *Clostridium tetani*, cause of tetanus. The organisms are magnified 1,200 times

#### TETANUS

(Lockjaw)

Tetanus is an acute, infectious disease manifested by persistent spasmotic contractions of the muscles of the body.

**Cause.**—The disease is caused by *Clostridium tetani*, an organism which is found in the soil (fig. 1). The animal becomes infected through wounds contaminated with infected soil. The tetanus organism gives off a highly poisonous toxin, which acts on the nerve cells and causes muscular irritability and spasms.

**Symptoms.**—Symptoms are acute in sheep and recoveries are exceptional. Death usually occurs in two or three days, but the animal may live a week. Stiffness is first noticed. The nose is held high, the tail elevated, and the back arched. Later the muscles are contracted, the head drawn backward, and the jaws locked. There is marked excitability; noises and sudden movements cause spontaneous muscular contraction. The animal lies on its side with legs rigidly extended.

Lambs, 48 hours after birth, may show symptoms as a result of navel infection. Large outbreaks may occur after castration, docking, or earmarking. Death usually comes early in lambs. Ewes may become infected following labor.

**Treatment.**—Animals showing symptoms may respond favorably to treatment with large doses of antitetanus serum if injected early in the course of the disease. Because of the expense this would be practicable only in the case of valuable animals. When tetanus

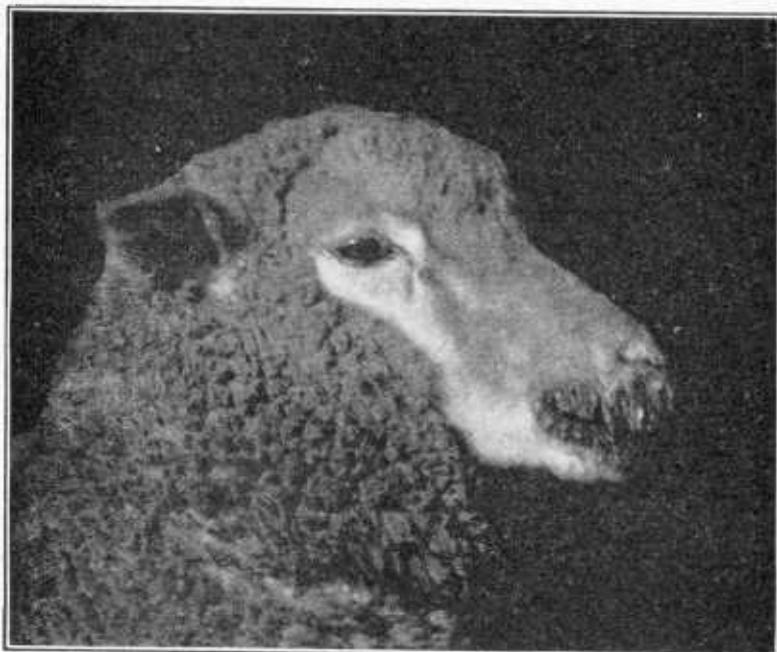


FIG. 2.—Lip-and-leg ulceration, showing lip lesions in ewe infected with germs obtained from warty lips of lamb

breaks out after castration or docking, the exposed animals may be protected by the serum treatment. Protective inoculation requires a much smaller quantity of serum than is required for treatment of animals showing symptoms. The entire flock should be removed from quarters in which the disease exists.

#### LIP-AND-LEG ULCERATION

(Necrobacillosis, sore mouth, contagious foot rot, warty lip, venereal disease)

The disease known as lip-and-leg ulceration is widely distributed in the United States. It is characterized by the formation of ulcers on any part of the exterior of the body, but principally (in the order named) on the lips, nose, chin, cheeks, gums, hard palate, legs and feet, and on the sheaths of bucks and wethers. The tail stumps of docked lambs, slit ears, shear cuts, and the vulvæ, udders, and teats of ewes may also be the seat of ulcers.

**Cause.**—The organism *Actinomyces necrophorus* causes the disease. It gains entrance to the tissues through wounds or abrasions from various sources and sets up areas of inflammation and decay.

The germ, which is widely distributed in nature, will not penetrate the uninjured skin.

**Symptoms.**—In the lip-and-leg form the lesions in some flocks are confined largely to the lips and muzzle, in other flocks to the legs, while in still others the seat of the lesions is about equally divided between the lips and legs (figs. 2 and 3). The mouth form is common in lambs. In the venereal form the genital organs of both sexes are attacked. In bucks the external part of the sheath is most frequently affected, and less often the ulcerations are con-

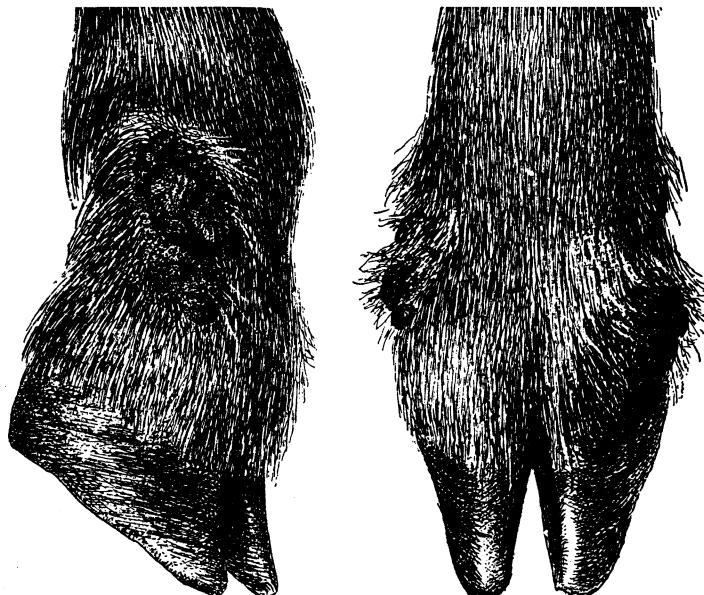


FIG. 3.—Lip-and-leg ulceration, showing leg lesions

fined to the penis. In ewes the skin and mucous membrane of the vulva, the underside of the tail, and the skin below the vulva show lesions. In the foot-rot form the lesions appear in the cleft, at the heel, or around the coronet. If no treatment is applied, the erosion progresses and fistulous passages are soon formed beneath the horny covering of the foot, while the softer tissues of the interdigital space gradually become degenerated and purulent. The invading micro-organisms possess marked burrowing ability, and the result of their invasion is that large areas of the hoof become separated from the sensitive tissues lying beneath. The degree of lameness depends on the severity of the foot lesions.

All forms of the disease may be found at times in the same flock. Sex or age does not appear to have any effect on the susceptibility of the animals.

The active stage manifests itself in the various locations by inflammation, swelling, ulceration, and gangrene, with or without scab formation. There may be considerable sloughing of the affected parts. A typical, offensive odor, similar to that of Limburger cheese, is given off from the infected areas. The chronic stage is charac-

terized by a stationary condition of the ulcers, without swelling or acute inflammation.

Losses from lip-and-leg ulceration are at times severe, reaching as high as from 20 to 30 per cent of the flock.

**Treatment.**—Treatment of this disease by local antiseptics is very satisfactory if begun in time and applied energetically. In mild, unadvanced cases the best results are obtained by removing the scabs and shreds of tissue from the diseased areas with a piece of sharpened wood. Then apply three or four times weekly a 3 per cent solution of one of the cresol or coal-tar dips, or better, a dressing containing 5 parts of one of these dips, 10 parts of sublimed sulphur, and 100 parts of mutton tallow, vaseline, or lard.

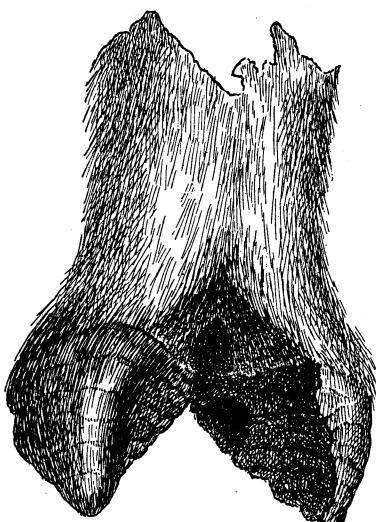


FIG. 4.—Early stage of foot rot.  
(After Brown)

loosened hoofs should be cut away. Affected animals should be separated from the healthy ones, and pens, corrals, and sheds thoroughly disinfected.

#### NONCONTAGIOUS FOOT ROT

(Canker of foot, foul, cutaneous abscesses, stoppage of biflex canal)

Noncontagious foot rot is distinguishable, as described below, from the contagious form known as lip-and-leg ulceration.

**Cause.**—Purulent inflammation of the cleft in the foot may occur in sheep pastured in low, swampy lands, or from accumulation of clay mixed with twigs, stubble, sharp pebbles, etc., in the cleft.

Wounds and cuts from stiff, pointed cut-over bushes, weeds, stubble, etc., may become filled with sand and fine gravel and may result in lameness and pus formation.

The opening of the biflex gland, situated between the toes of sheep, may become plugged by mud or sand. This not only stops the flow of the oily secretion for lubricating the tissues in the cleft of the foot but causes inflammation and the formation of pus in the biflex canal.

In actively progressive cases or in aggravated chronic forms it is desirable to remove the scabs, scrape all the soft, spongy tissues from the ulcers, and touch the affected area with a 10 per cent solution of zinc chloride or with nitric acid in the strength of 1 part to 7 parts of water. The healthy skin surrounding the ulcers may be smeared with tallow, vaseline, or other oily substance to prevent injury from the caustic solutions. After using either of the caustic solutions the subsequent treatment should consist of three applications weekly of the above-named cresol or coal-tar dressing, which is antiseptic but not caustic.

Boils or abscesses should be opened with a knife, cleaned out, and dressed with the antiseptics mentioned. Portions of diseased or

Sores or abscesses varying in size from that of a millet seed to that of a silver dollar may appear just above the coronet or in the region of the ankle as a result of sheep having to wade daily through muddy or filthy yards or pens. The abscesses are caused by pus-producing organisms different from the organism of lip-and-leg disease.

**Symptoms.**—In all forms of noncontagious foot disease, lameness is a prominent symptom. An examination of the affected feet, the fact that few animals suffer from the ailment in most cases, and a consideration of the probable causes will help one to distinguish the disease from the contagious foot rot known as lip-and-leg ulceration.

**Treatment.**—Foreign material, such as caked clay, sand, pebbles, etc., should be removed, wounds or cracks washed, abscesses opened with a clean, sharp knife, and antiseptics, such as 5 per cent carbolic acid or 2 per cent compound solution of cresol, applied to the affected parts. Poultices may be applied to open abscesses and held in place for several days by a bandage. Portions of diseased or loosened hoofs should be cut away. Removal of the flock from muddy or filthy surroundings to dry, clean places checks the spread of the abscesses.

#### NECROBACILLOSIS OF THE NAVELS OF LAMBS

**Cause.**—The organism *Actinomyces necrophorus*, which causes lip-and-leg ulceration, may be responsible also for extensive outbreaks of an internal disease of lambs. The organism gains access to the liver by way of the navel cord during the first day or two after birth.

**Symptoms.**—The disease is rapid in its course. The affected animal shows general symptoms of disease and death follows in from 2 to 10 days after birth. In one case reported in Nevada more than 1,500 lambs died from this trouble out of 5,200 lambs born on the ranch that season.

**Post-mortem appearance.**—The most characteristic lesions are the presence of grayish, diseased spots up to 2 inches in diameter on the liver. Infection may spread to adjacent organs by contact. When cut into, the diseased spots give off a peculiar, offensive, glue-like odor.

**Treatment.**—Medicinal treatment is ineffective. The disease is prevented by good sanitary conditions at lambing time. If it has broken out the flock should be moved to new ground or quarters. The navel cord should be disinfected soon after birth with 10 per cent carbolic acid or 5 per cent compound solution of cresol and preferably tied close to the navel.

#### WHITE SCOURS OF LAMBS

(Infectious diarrhea)

White scours is an acute, infectious disease manifested by profuse diarrhea. It attacks lambs shortly after birth or within two or three days, frequently affecting all the newborn in the flock. It is not common in range flocks.

**Cause.**—A variety of microorganisms has been found associated with the disease, but the most common of them is *Bacterium coli communis*. Dirty lambing pens or ground contaminated with the virulent organisms soils the udders of the ewes and the organisms are taken up by the lambs in suckling. Cold and rain weaken the young lambs and predispose them to infection.

**Symptoms.**—Symptoms appear in from one to three days after birth. The lamb stops suckling, is depressed, and lies down much of the time. The feces may be yellowish or grayish white and may be tinged with blood. They are fetid and fluid. Death occurs in from one to several days after symptoms are shown.

White scours is distinguished from simple diarrhea by its tendency to affect a large number in the flock at the same time.

**Treatment.**—Affected lambs should be isolated and given 2 teaspoonfuls of castor oil and an internal antiseptic, such as salicylic acid in doses of one-third teaspoonful daily for several days. Anti-white-scours serum may be injected shortly after birth as a preventive. On farms where the disease has already occurred, ewes, before lambing, should be placed in clean, disinfected quarters.

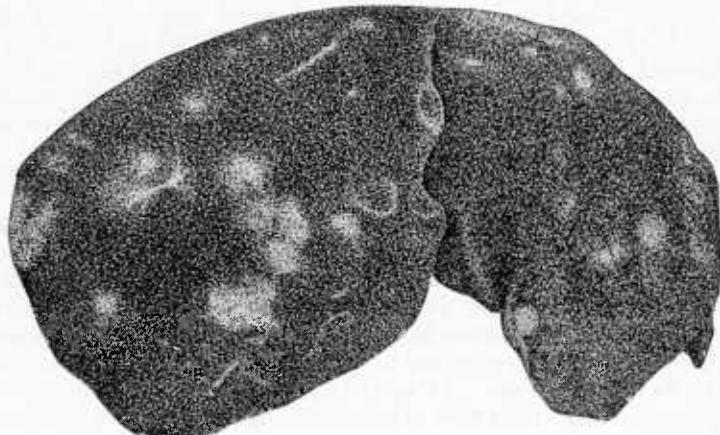


FIG. 5.—Liver of lamb, showing necrotic spots

**JOINT ILL OF LAMBS**  
(Navel ill, septic joint disease)

Joint ill is an acute, infectious disease of newborn lambs which is characterized by swelling of the navel and joints of the limbs.

**Cause.**—Several common disease-producing organisms may cause joint ill. Infection occurs principally before the stump dries, by way of the vein of the torn navel cord, which has become soiled by dirt or other material harboring the pathogenic organisms.

**Symptoms.**—Signs of the disease usually occur within 48 hours after birth. The navel cord swells, contains a purulent substance, and dries slowly. The animal is dull, lies down a good deal, and loses the desire to suck. There is stiffness and swelling of the hocks, stifle joints, or knees. A purulent secretion may escape from an opened joint. There may be a general septic condition.

**Treatment.**—Not much can be done in the case of badly affected animals other than to open and disinfect the navel stump and to nourish the animal artificially with milk. Recovery is rarely complete.

To prevent the disease place the pregnant ewes, shortly before lambing, in clean, disinfected quarters containing clean, fresh straw. Wash the navel cord of the newborn lamb with 10 per cent carbolic-

acid solution or 5 per cent compound solution of cresol as soon after birth as possible and repeat daily for two or three days. Tying the navel cord close to the navel is also advisable.

**CASEOUS LYMPHADENITIS**

(Cheesy bronchopneumonia, pseudotuberculosis)

Caseous lymphadenitis is a chronic, infectious disease of the lymphatic system. The disease is common in the United States and many cases are observed by inspectors in slaughtering establishments.

**Cause.**—It is caused by an organism, the bacterium of Preisz.

**Symptoms.**—The presence of the disease is seldom noticed except through post-mortem examination. Because of its slow, chronic course it has no marked effect upon lambs and sheep marketed before they are 2 years old. In older animals the prescapular lymph glands (in front of the shoulder) and the praeauricular lymph gland (in the flank) may be enlarged to the size of an egg or larger and may be readily seen or felt. The animal may show unthriftiness or emaciation. Fatal cases are rare.

**Post-mortem appearance.**—One or more of the lymph glands of the body wall and internal organs are greatly enlarged and filled with a greenish-yellow, cheesy mass. The lungs may be studded with small tumors the size of a pea, and the liver and spleen may contain one or more tumors. These show the same characteristic greenish-yellow material. Chronic pleurisy and lung adhesions are often present.

**Diagnosis.**—The disease is distinguished from tuberculosis, which is rare in sheep, by the greenish-yellow, cheesy appearance of the tumors.

**Treatment.**—No remedy is effective. The meat of animals which do not show extensive lesions or emaciation is fit for food. Affected parts should be destroyed.

**TUBERCULOSIS**

(Consumption)

Tuberculosis is a chronic, infectious disease characterized by the formation of caseous nodules or tubercles in the lymphatic glands and internal organs. It is very rare among sheep in America.

**Cause.**—The organism *Mycobacterium tuberculosis* causes the disease. It is contracted by exposure to infected animals, whose discharges contaminate the feed, drinking water, or air. Infection from contact with tuberculous cows has been reported.

**Symptoms.**—There is a gradual emaciation associated with lung trouble and coughing. The lymph glands of the throat may swell and cause bloating.

**Post-mortem appearance.**—Some of the lymph glands of the head, throat, chest, and abdominal cavities, or body wall are enlarged and contain a yellowish, cheesy, or gritty material. The lungs, liver, spleen, or kidneys may be the seat of tumors containing such material.

**Diagnosis.**—The disease may be confused with caseous lymphadenitis, a common disease of sheep. The tumors of the latter disease are usually composed of greenish-yellow, cheesy material. Tuberculosis may be diagnosed by the application of the tuberculin test.

**Treatment.**—No treatment is effective. Tuberculous animals should be destroyed.

## RABIES

(Hydrophobia)

Rabies is an acute, infectious disease affecting the brain and ending in paralysis and death.

**Cause.**—It is caused by a living virus which is transmitted to animals and man by the saliva of rabid animals through biting. Dogs are most frequently responsible for the spread of rabies, but any affected animal that bites another may transmit the disease.

**Symptoms.**—Symptoms begin between two and four weeks or somewhat longer after the animal is bitten. Death takes place in from two to eight days later. There is loss of appetite and a stopping of rumination, great unrest, stamping of feet, and butting or charging others of the flock. The affected sheep will attack a dog or other intruder. The head may be carried high and a little to one side. Bleating is higher in tone and more plaintive. Increased sexual excitement is marked, especially in the rams, the animals continually riding one another indiscriminately. Sheep will nibble at wood and swallow indigestible material of any kind. Occasionally a form of dumb rabies is found, in which violent symptoms are not pronounced. Lambs have convulsive fits and die in a day or two. Paralysis of the limbs precedes death.

**Post-mortem appearance.**—No characteristic changes are observed in the internal organs, except through microscopic examination of the brain. The finding of small, round, foreign bodies, known as Negri bodies, in the brain cells, establishes a positive diagnosis of rabies.

**Treatment.**—Affected sheep can not be cured. Those known to have been bitten by rabid animals may be protected against the disease by the Pasteur vaccine treatment if promptly given. This is expensive, but may be warranted in the case of valuable sheep.

## FOOT-AND-MOUTH DISEASE

(Aphthous fever)

Foot-and-mouth disease is a highly infectious, acute, febrile disease of cloven-footed animals. Horses, dogs, cats, poultry, and even man may become infected. It is characterized by the formation of vesicles or blisters on the membrane of the mouth and on the skin between the toes and above the hoofs. The disease does not exist in the United States. Since it has broken out on several occasions, however, through infection from abroad, it is a disease with which every livestock owner should be familiar.

**Cause.**—The cause of the disease is too small to be seen with a microscope and is known as a filterable virus. Transmission occurs by direct contact with infected animals or by any agency, such as man, other animals, feed, animal products, etc., contaminated with discharges from affected animals.

**Symptoms.**—In sheep the lesions are more pronounced in the feet, the blisters being less well marked in the mouth than is the case in cattle. All four feet generally are the seat of small blisters, which form on the skin between the toes, on the heel, or around the top of the hoof. The animal is restless and kicks with the hind feet. Pain becomes intense, severe lameness is shown, and the animal rests on

the knees or breastbone in feeding and lies down most of the time. The blisters rupture, discharging a clear or yellowish fluid, which later may be cloudy or purulent. Frequently the hoof separates from the wall.

In the mouth small blisters form on the incisor pad, lips, tongue, cheeks, or hard palate. These rupture, discharging a clear fluid and leave small, reddened surfaces which heal rapidly. A considerable part of the membrane of the mouth may be cast off. The animal often makes a smacking sound or grinds the teeth.

Blisters may appear on the udder or teats. There is a general constitutional disturbance, diminished appetite, and loss of condition. The temperature rises at first and then drops to normal.

The disease runs its course in from two to three weeks, but is prolonged by severe foot lesions or by complications. The mortality is higher among lambs than among grown sheep.

**Diagnosis.**—Foot-and-mouth disease is readily recognized by the rapid spread of the disease in a flock, or to cattle and hogs, by the characteristic blisters on the feet or in the mouth and by the severe lameness in more than one foot. In foot rot of sheep, lameness is present in the affected foot; but in that case the lesions are in the form of ulcers, which usually develop at the heel and may extend deeply into the tissues, causing erosions which discharge a purulent matter. A pungent, disagreeable odor also is quite characteristic of foot rot.

**Treatment.**—Medical treatment is not practiced in this country, as the danger that the disease will spread from an infected flock is too great. On each occasion when an outbreak has occurred slaughter of the affected herds as early as possible has prevented the disease from gaining a permanent foothold in the country. During outbreaks of foot-and-mouth disease suspicious cases should be immediately reported by telegraph to the State livestock authorities or to the United States Bureau of Animal Industry.

#### SHEEP POX

(Variola ovina)

Sheep pox is an acute, infectious, eruptive disease of the skin, which spreads rapidly through a flock. It is prevalent in Europe, but is not known to exist in America.

**Cause.**—Sheep pox is caused by a living, filterable virus, and is contracted principally by inhaling dust and air containing pox-scab material.

**Symptoms.**—The disease begins with high fever and general constitutional disturbance. Round, red spots appear on the parts of the skin which are free from or only lightly covered with wool. Papules soon develop on these spots and are succeeded by vesicles containing a yellowish or pale-red fluid. The vesicles later become pustules and then dry up to form a scab which is cast off. The animal gives off a peculiar, sweetish, repulsive odor. The disease lasts about three or four weeks, and the mortality, except in severe outbreaks, runs from 5 to 10 per cent.

**Treatment.**—European authorities advise slaughter of the first animals affected. Preventive vaccination is successful, but is carried on under Government permit, because of the danger of spreading the disease.

## ACTINOMYCOSIS

(Lumpy jaw, wooden tongue)

Actinomycosis is a disease rare in sheep, caused by the ray fungus *Actinomyces bovis*, which forms cheesy tumors in the tongue. Occasionally the lips, jaws, or lungs may be affected.

**Treatment.**—Give 2 grains of potassium iodide in the drinking water daily for a period of two weeks.

## GENERAL DISEASES

## JAUNDICE

(Icterus, yellows)

Jaundice is a common disease of sheep, but it is not often noticed except at slaughter. It is characterized by the yellowish appearance of the tissues of the body.

**Cause.**—Jaundice results from various affections of the liver, flukes being a common cause. When the bile does not flow freely into the intestine the coloring matter is absorbed into the blood, and a yellowish coloration of the body results.

**Symptoms.**—The membranes of the mouth, nostrils, and eyes are yellowish. The urine is stained varying shades of yellow. On post-mortem the carcass shows a yellow discoloration which often disappears after a day or two.

**Treatment.**—A purgative, such as Epsom salt or Glauber salt, 4 ounces, may be given, likewise opportunity for exercise.

## ICTEROHEMATURIA

(Red water, malarial fever, jaundice)

Icterohematuria is a highly fatal, febrile disease which is apparently restricted to limited areas. It has been reported from certain valleys in Montana and from Colorado.

**Cause.**—In Europe the disease has been attributed to a blood parasite of microscopic size. In this country its cause has not been definitely established.

**Symptoms.**—Severe cases are characterized by weakness; reddish or bloody urine; yellowish coloration of the membranes of the eyes and nostrils; swelling of the head, ears, or neck; stupor; unconsciousness; and sometimes convulsions followed by death in from two to five days after symptoms are noticed. In mild cases no marked symptoms may be observed, but yellowish discoloration of the body tissues is seen on slaughter.

**Post-mortem appearance.**—The skin and fat are yellowish in color, and the muscles slightly yellowish. The blood is pale, the liver is yellowish and easily crumbled, and the gall bladder is filled with yellowish-green or greenish-black bile. Kidneys are enlarged, soft, and contain bloody or dark-colored urine. The bladder contains bloody or chocolate-colored urine. Yellowish or yellowish-green, gelatinous liquid is found beneath the skin, between the muscles, or in the body cavities.

**Treatment.**—Quinine, one-third teaspoonful twice daily, is recommended, also Epsom salt or Glauber salt, from 2 to 4 ounces. The disease is prevented by keeping sheep away from pastures where the condition exists.

**PERITONITIS**

Peritonitis is an inflammation of the membrane lining the belly cavity and covering the abdominal organs.

**Cause.**—It is seen generally after castration of lambs or following inflammation of the womb in ewes. It results from infection.

**Symptoms.**—The principal symptoms are evidences of abdominal pain. There is plaintive bleating, grinding of the teeth, and the animal frequently draws the head around toward the flank. The temperature rises. The hind legs may be dragged stiffly and the belly may be tucked up. Fluid may be felt in the belly.

**Treatment.**—The castration wound should be washed with antiseptics. Stimulating liniments or mustard water may be applied to the abdomen.

**ASCITES**

(Abdominal dropsy, water belly)

The condition known as ascites represents an accumulation of fluid in the belly.

**Cause.**—Ascites may be present in several general diseases, and in peritonitis, internal parasitic infestation, or in debilitated animals, especially during pregnancy.

**Symptoms.**—Gradual enlargement or bulging of the belly is a common symptom. Manipulation of the belly will cause the fluid to fluctuate or move about. There is a dull sound on thumping the abdomen. Affected ewes may give birth to water-bellied lambs.

**Treatment.**—The ailment which causes the condition should be treated. Give one-half teaspoonful of potassium iodide daily in a little water as a drench. The belly may be tapped and the fluid drawn off.

**ANEMIA**

(Hydremia, chlorosis)

Anemia is a condition in which the blood is deficient in either quality or quantity.

**Cause.**—It is most frequently due to insufficient feed or to feed deficient in proteins and mineral substances, such as iron. It occurs often in animals grazing on marshy pastures. Ewes suckling lambs become anemic when the quantity or quality of feed is inadequate for their needs. Anemia is also associated with chronic wasting diseases and with heavy infestation with parasites.

**Symptoms.**—The visible membranes of the eye, nose, and mouth are pale. There is dullness, weakness, and emaciation. A dropsical swelling forms under the lower jaw and may extend down the neck to the chest. The belly becomes dropsical. The wool is lusterless, harsh, or brittle, and falls off in patches. Diarrhea is present in the late stages. The animal may die from loss of strength after several weeks, or the disease may continue for months.

**Treatment.**—Change of feed or pasture is essential. A sufficient quantity of nutritious feed should be given; also administer iron sulphate (copperas) in from 8 to 15 grain doses daily. Arsenic in the form of Fowler's solution in from one-quarter to 1 teaspoonful daily and vegetable tonics, such as gentian or ginger, in from 1 to 2 teaspoonful doses are of value in aiding rapid recovery.

## RICKETS

(Rachitis, leg weakness)

Rickets is a disease of lambs in which the bones are soft and flexible from lack of proper mineral content.

**Cause.**—Failure of the bones to receive enough mineral salts, especially lime and phosphates, may be due to faulty processes in the body, but is usually due to lack of lime salts in the feed and to lack of exercise. Suckling lambs may become affected if the mothers do not get feed enough, or if the feed is low in lime content. Some soils are deficient in lime, and feed grown on them is also deficient. Lambs closely confined, even if properly fed, may develop rickets.

**Symptoms.**—The symptoms are most apparent in the long bones of the legs. Nodular enlargements may be observed on the ends or sides of the bones, which are soft and porous. They are bent or bowed outward, inward, or backward. The spine may be curved also. Stiffness or lameness is present. The animal does not like to move about, lies down a good deal, or crawls about and kneels when eating. The second set of teeth is slow in coming. The licking or nibbling of walls is observed; and there is a desire for filth and for foul water.

**Treatment.**—Lambs should not be penned closely, but should be allowed plenty of room for exercise. They should also have nutritious feed, grown on good soil. Lambs should be given new pasture or plenty of green feed, timothy hay, clover, alfalfa, pea hay, oats, linseed cake, or other feeds rich in lime and phosphates. Dams of nurslings should be well fed on such feeds. Chalk (calcium carbonate) may be given to ewes with suckling lambs, or to lambs, in doses of from one-half to 2 teaspoonfuls daily, or sodium phosphate may be alternated with the chalk. Cod-liver oil promotes the deposit of lime and phosphates in the bones and should be given in one-third teaspoonful doses daily.

## GOITER

(Big neck, woolless lambs)

Goiter is characterized by a swelling of the thyroid gland, which is situated in the throat just below the lower jaw. It is quite common in sheep in various regions. Lambs from affected flocks show absence of wool and enlargement of the throat. Many are born dead, and some die shortly after birth. Those that live are often unthrifty.

**Cause.**—The disease is caused by lack of iodine in the thyroid gland. This appears to be due to a scarcity of iodine in the vegetation and water in certain districts. Where the pregnant ewe can not get iodine enough the normal growth of the fetus is arrested.

**Treatment.**—In flocks where the disease exists pregnant ewes should be given potassium iodide daily for three months before lambing. One-half ounce of potassium iodide mixed with one-half ounce of milk sugar and dissolved in the drinking water daily is sufficient for 100 ewes.

## RHEUMATISM

**Cause.**—Rheumatism does not occur so often as a separate affection as formerly believed. Symptoms of soreness, lameness, or stiffness associated with various internal diseases are popularly termed rheumatism. Rheumatism, independent of other ailments, is generally

due to cold drafts and dampness. It affects the muscles and to a less extent the joints. Young animals are usually affected.

**Treatment.**—Protection against the causes, with application of stimulating liniments to the affected parts, will help restore the animal to health.

#### WOOL EATING

**Cause.**—Wool eating is observed principally in winter, when sheep are confined to close quarters. It is often only a bad habit, which, when started by one or more animals, is imitated by others. In other cases lack of essential mineral elements in the feed may cause the habit.

**Symptoms.**—Lambs begin by gnawing the wool of their mothers, usually on the thighs and abdomen. Older sheep may select one animal and eat all its wool before turning to another. Wool eating may become general in the flock. A few lambs may become anemic, show digestive disturbance, or even die as a result of the formation of wool balls in a compartment of the stomach and the subsequent plugging of the intestine.

**Treatment.**—Wool eaters and their victims should be removed from the flock. Animals should be turned out for exercise, and nutritious feed should be provided.

#### DISEASES OF THE HEAD AND AIR PASSAGES

##### BIGHEAD

Bighead is characterized by a sudden swelling of the head and ears. The affection is not very widely distributed. It is found in Utah and the surrounding States, the greatest losses occurring in southern and central Utah, southern Idaho, eastern Nevada, and western and southern Wyoming. It is also seen occasionally in sheep brought as feeders from those regions into the Middle Western States. In such cases the disease occurs shortly after the arrival of the animals early in the autumn if heat is excessive.

**Cause.**—The definite cause of bighead is not known, though climatic conditions have much to do with its appearance. Sheep are usually affected during the spring and early summer while being driven from the winter to the summer ranges, more commonly before shearing. Bighead appears to be most prevalent after a cold or stormy night, when the day following turns hot and the animals are driven fast in the hot sun, and when they are compelled to inhale a considerable quantity of alkali dust. It affects males and females alike, though it is seldom seen in young lambs. This condition affects sheep in much the same way as man is affected by poison ivy. The disease is not transmissible from one sheep to another or to other animals. All experiments with infusion of blood or injection of serum from the affected sheep to healthy ones were without results.

A disease of sheep in Europe, known as fagopyrism, or buckwheat poisoning, is similar to bighead. In one experiment in America bighead was produced by feeding buckwheat and exposing the animals to the sun. In another experiment the results were negative. On the desert and on different parts of the trail sheep eat a number of plants that belong to the buckwheat family, and it is possible that the trouble may come from that source.

**Symptoms.**—The first noticeable symptom is that the animal begins to throw its head up and sidewise in a jerking manner. It is

greatly irritated and shakes the head and tries to rub it. The animal walks aimlessly through the flock, often stamping its feet on the ground, and seldom standing still very long. The eyesight is affected, as the animal follows a direct line, sometimes running into other sheep and objects in its path. In that condition some of the sheep wander away from the flock and are lost, either dying as a result of exhaustion and starvation or becoming a prey to wild animals.

If the animal is watched after the jerking of the head begins, one can see the ears turn red and enlarge. At about the same time the cheeks show a congested appearance. Ears and cheeks continue to enlarge to enormous proportions, the ears drooping as a result of their weight. After the swellings are about complete, small drops of serum of a light-yellow color begin to exude from them. The entire face becomes so swollen as to close the eyes, and in some cases the internal pressure of the serum forces the eyeballs out of their sockets. Fever is always present and shows itself early, the temperature ranging from 104° to 107° F. In the severe forms this occurs in from 30 minutes to 1 hour. The vision being obstructed, the animal can not see its feed and the lips, cheeks, and tongue are so badly congested that eating is impossible. In many cases the tongue fills the mouth entirely. In some cases there is a disturbance of the breathing, due to pressure on the trachea and inflammation of the air passages. To some extent this may be due to excitement, and when in that condition the sheep, if allowed to, will continue to chase around until completely exhausted and will then lie down, usually never to rise. Others that are only slightly affected may recover. The skin often cracks or peels off the swelled areas and many animals lose the wool over the entire body. Sheep once affected are never so good as formerly, as they become unthrifty. Many of the ewes that carry lambs lose them.

**Post-mortem appearance.**—Sheep killed during the early stages of the disease show petechiæ (purplish spots) in the nostrils and all tissues of the head, trachea, and lungs. There is an accumulation of serous or jellylike fluid around the eyes, in the cheeks, between the ears, below the jaws, and under the mucous membrane of the mouth and tongue.

When sheep die as a result of this condition, the jellylike material is found in different parts of the body under the mucous and serous membranes and in some of the muscles. There are often small hemorrhagic spots along the intestinal tract and around the kidneys. There is a congestion and thickening of the walls of the lymphatics, with a swelling of the lymph glands. The blood circulation of the head in many instances is nearly shut off by the pressure of the swollen condition. The brain and spinal cord of the dead animal contain an excessive amount of serum. The muscle tissue appears normal in most parts of the body except the head.

**Treatment.**—Different medicinal substances were experimented with on affected sheep with the view of finding some specific that might overcome the trouble. The substances that do the animals most good are emollients, such as vaseline or olive oil, applied to

the head. Whenever affected sheep have absolute rest and some protection from the direct rays of the sun and their heads are smeared with emollients they recover in a short time, while those that are not treated in this manner, but are driven indefinitely without these precautions, become severely affected, many of them dying as a result.

The malady is prevented by handling sheep properly, not driving them too far or too fast on the trail during the heat, especially before shearing in the spring.

Sheepmen should not become excited when bighead develops in their flocks and cause the herders to rush the sheep over the ground, as they do where poisonous plants exist. Keep the animals cool so far as possible, and many great losses can be prevented.

#### SORE EYES

(Conjunctivitis, ophthalmia, the blinds)

**Cause.**—Disorders of the eye may arise from a number of causes. Inflammation may follow injuries, or inclusions of dust, seeds, pollen, etc., or may accompany other diseases, such as catarrh. At times inflammation of the eye becomes prevalent in a particular district or region.

**Symptoms.**—The eye is kept closed, especially when exposed to light. Tears flow freely. At first the discharge is watery, but later it may become purulent. The eye membranes are swollen and red. The eyeball may become clouded or milk white, and in bad cases it may ulcerate and rupture. Cataract and blindness frequently follow successive attacks of ophthalmia.

**Treatment.**—Any foreign matter in the eye should be removed. The eye should be washed with 3 per cent boric-acid solution, or, better still, after washing the eyes with lukewarm water place several drops of 15 per cent solution of argyrol on the eyeball. Treatment should be given twice a day, the animal being kept in a dark place if possible.

#### NASAL CATARRH

(Snuffles)

**Cause.**—Exposure to dampness, rain, or cold weather after shearing predisposes sheep to catarrh. Lambs with little wool are also susceptible. Continued exposure to bad weather, nasal affections, and parasites in the head or lungs may produce chronic catarrh.

**Symptoms.**—In acute catarrh the discharge begins as a clear fluid, which later becomes thick, stringy, and yellowish. It may plug the nostrils by drying around the openings. The eyes also may become congested and show a discharge. In chronic cases a yellowish, fetid discharge continues from the nose and is especially marked after exposure to bad weather.

**Treatment.**—House or shelter the sheep in bad weather. The nostrils may be washed out and sprayed with cresol or coal-tar disinfectant in 2 per cent solution. Weak animals may be given a stimulant, such as sweet spirits of niter. Powdered carbonate of iron, 2 teaspoonfuls, and powdered gentian, 2 teaspoonfuls, may be given night and morning in the feed.

**BRONCHITIS**

**Cause.**—Exposure to wet windy weather or shearing or dipping in cold weather may cause an inflammation of the air tubes. Bronchitis may also follow nasal catarrh or may be due to worms in the air passages.

**Symptoms.**—There is a cough, which is dry and painful at first, followed by a moist cough. There is also a discharge from the nose and mouth.

**Treatment.**—Provide warm dry quarters, and smear pine tar over the nostrils.

**PNEUMONIA**

(Lung fever, congestion of the lungs, pleurisy)

Pneumonia is an inflammation of the lungs, and may be brought on by a variety of causes. Young lambs are frequently affected by a severe form of septic pneumonia. Pleurisy often accompanies or follows pneumonia.

**Cause.**—The most important causes in sheep are microorganisms and parasites. Pneumonia is often associated with specific diseases, such as hemorrhagic septicemia, anthrax, or white scours of lambs. Several varieties of microorganisms produce pneumonia, especially in lambs when the animals become predisposed to infection through outside influences. Animals sheared during the winter months or dipped during cold weather may be attacked. Cold, wet, foggy seasons predispose to pneumonia. Lambs may be affected by sucking unclean udders or may contract an infectious form of pneumonia from other lambs. Wound infection following castration may produce pneumonia.

**Symptoms.**—There is fever, increased blowing respiration, flank breathing, cough, nasal discharge, and loss of appetite. The animal stands persistently or rests on the breastbone. In the septic form in lambs the course is rapid, deaths occurring in from two to six days. The more chronic forms last from three to six weeks. In the milder cases the condition generally improves and recovery is apparent after several weeks.

**Post-mortem appearance.**—On autopsy the lungs are found engorged with blood and one or both lungs may be solidified. The pleura may be inflamed and show adhesions with the lungs. The chest cavity may contain fluid.

**Treatment.**—The causes which predispose to pneumonia should be eliminated so far as possible by proper management and housing. Infected animals should be isolated and sanitary measures instituted. Flour and bran gruels should be given. Salicylate of soda should be given in the drinking water in the proportion of 2 teaspoonfuls to each gallon.

**"LUNGER DISEASE"**

A chronic form of pneumonia, commonly known as "lunger disease," is prevalent in certain areas of the Northwest. It appears in aged sheep that have been kept under range conditions. In bands where the disease exists, it is estimated that from 2 to 10 per cent of the animals become affected.

**Symptoms.**—The outstanding symptoms are difficult breathing, which becomes more labored as the disease progresses, dilated nostrils, and a slight cough which is sometimes accompanied by a nasal discharge. The animals become emaciated and finally die from exhaustion.

**Treatment.**—As a precautionary measure all affected sheep should be removed from the flocks and either slaughtered or kept isolated. As exposure may be a possible predisposing factor, it is advisable to protect flocks from extreme weather whenever possible.

#### DISEASES OF THE DIGESTIVE SYSTEM

##### DEFECTIVE TEETH

Animals which show poor condition, indigestion, or dropping the cud may be found upon examination to have supernumerary, defective, or broken teeth, diseased gums, or, in the case of old ewes, teeth may have fallen out. Defective or supernumerary teeth should be removed, or the affected animals prepared for slaughter.

##### DROPPING THE CUD

**Cause.**—When an animal drops the cud, disease of the teeth or sore mouth may be looked for. In other cases it is due to acidity of the stomach or inferior feed.

**Symptoms.**—The contents of the stomach are returned to the mouth for mastication, but owing to acidity, bad taste, or to pain in chewing, the feed is dropped from the mouth. Quantities of half-chewed feed may be found on the ground.

**Treatment.**—The mouth or teeth should be attended to if found diseased. Baking soda in from 1 to 2 teaspoonful doses will counteract excessive acidity of the stomach. A purgative, such as Epsom salt in 4-ounce doses, may be given. A good quality of feed should be provided.

##### STOMATITIS

(Necrotic stomatitis, sore mouth of lambs, thrush)

Stomatitis is an inflammation of the mouth. It may occur in several forms, as catarrhal, aphthous, necrotic, and mycotic.

**Cause.**—Catarrhal stomatitis, or simple redness of the mouth, is due to irritants in the feed or to irritating mineral or poisonous substances. Aphthous and necrotic stomatitis are caused by micro-organisms. Mycotic stomatitis is caused by fungi or molds.

**Symptoms.**—In catarrhal stomatitis a diffuse redness of the membranes covering the tongue, cheeks, and hard palate is observed. In the aphthous form patches of yellowish-gray false membranes, made up of cast-off fibrin and exudates, are found on the tongue, gums, and at other points in the mouth and throat. In the necrotic form small ulcers or decayed spots are present. The mycotic form also presents ulcerated areas.

In all forms sucking or the taking of feed is painful. Saliva dribbles from the mouth. A disagreeable odor is given off. Frequently the animal is stiff in the limbs, and the back may be arched. There is an unthrifty appearance and loss of flesh. In very young lambs the disease takes a rapid and fatal course. Older animals generally recover.

**Treatment.**—Separate the sick from the healthy. Lambs unable to suck should receive milk artificially. Older animals should have bran mashes, ground feed, or gruels. The mouth should be swabbed out daily with such antiseptics as compound solution of cresol, carbolic acid, or permanganate of potash in 2 per cent solution. It is also beneficial to dissolve 2 tablespoonfuls of borax in each pail of drinking water.

#### CHOKING

**Cause.**—Choking occurs as the result of the lodging of a piece of root or dry, coarse feed in the gullet.

**Symptoms.**—Difficult breathing, head stretched out, attempts to swallow or to vomit, stoppage of rumination, and bloating suggest choking. Feeling along the gullet will reveal the obstruction.

**Treatment.**—If the obstruction is near the mouth, it may be fished out with the fingers or an instrument or forced up by outside pressure. If farther down, a little linseed oil may be given and the material pushed toward the paunch by means of a rubber tube or stout, looped wire. In obstinate cases immediate slaughter may be advisable.

#### INDIGESTION

(Impaction of rumen, atony of stomach, grass staggers)

**Cause.**—Indigestion results from the presence of other diseases; from feeding coarse, fibrous, indigestible feed with little green feed; from spoiled feed; or from overloading the stomach. The fourth stomach of lambs may become impacted with curdled milk.

**Symptoms.**—There is dullness, loss of appetite, and rumination, bad-smelling eructations, constipation with passing at long intervals of bad-smelling, dry, undigested dung in small quantities. The left flank may be distended and feel doughy to the touch.

**Treatment.**—Give purgatives, such as Epsom salt or Glauber salt in from 2 to 3 ounce doses, or castor or linseed oil from 3 to 6 ounces. One-half ounce of turpentine may be mixed with the oil. Work up the paunch with the hands over the left flank. When the animal begins to eat give succulent green feed for a few days.

#### BLOATING

(Hoven, tympanitis)

Rapid formation of a large quantity of gas in the paunch causes a bloating or distention of the abdomen:

**Causes.**—Heavy feeding on various green feeds, such as alfalfa, clover, green oats, or pea vines, especially when wet or frosted, or on grains, frozen fruits, or cabbages, turnips, etc., may bring on bloating. These feeds readily ferment when the paunch becomes inactive or paralyzed from overdistention and a large quantity of gas accumulates.

**Symptoms.**—Evidence of bloat is readily apparent. It appears first in the left flank as a tense swelling, which sounds drumlike on tapping with the hand. Breathing is difficult from pressure on the lungs, the animal is distressed, staggers, and drops to the ground. Death results from suffocation.

**Treatment.**—In acute cases the flank should be punctured in its most prominent part with a clean trocar and cannula and the trocar withdrawn to allow the gas to escape through the cannula.

A stomach tube or small rubber tube passed down the gullet serves the same purpose. Large doses of antiferments and stimulants, such as aromatic spirits of ammonia, one-half ounce in 5 ounces of water, and turpentine, one-half ounce in 6 ounces of linseed or castor oil, should be given. Driving the animal through cold water or pouring cold water over the body is beneficial. Keeping the mouth open by gagging with a smooth stick tied behind the ears and massaging the paunch with the fist against the left flank will aid in causing a belching of gas.

**GASTROENTERITIS**

(Inflammation of stomach and intestines)

**Cause.**—Severe inflammation of the stomach, generally the fourth compartment or abomasum, and of the intestine is most often found associated with one of the infectious diseases or with extensive parasitic infestation. Other inflammations may be due to moldy or irritating feeds, poisons, and causes which are included among the causes of colic, indigestion, impaction, and bloat.

**Symptoms.**—There is loss of appetite, constipation followed by diarrhea, slimy or bloodstained feces, straining, colicky pains, and tenderness of the abdomen. The animal becomes poor, weak, and dull.

**Post-mortem appearance.**—The membrane lining the fourth stomach and intestine will be found inflamed, or covered by a catarrhal, slimy deposit. The membrane may be cast off in places. The cause of this inflammation is often apparent at autopsy.

**Treatment.**—Stimulants and purgatives are required. These may include aromatic spirits of ammonia from one-quarter to one-half ounce in 5 ounces of water or linseed oil, and castor oil or Epsom salt, 4 ounces. Nourish with warm, soothing drinks containing eggs or milk. Provide warm quarters and feed carefully during recovery.

**COLIC**

(Bellyache, stretches)

**Cause.**—Colic is an acute, abdominal pain which may be due to a variety of causes, among which may be mentioned gastritis or inflammation of the stomach, enteritis or inflammation of the intestine, bloating, obstruction in intestine or stomach, twisting of intestine, indigestion, constipation, sand in stomach or intestine, gallstones in the liver and its ducts, kidney stones in the kidneys or urinary tubes, worms, and peritonitis.

**Symptoms.**—Pain is shown by uneasiness, moaning, grinding of the teeth, stretching, getting up and lying down frequently, striking the belly with the hind feet, and looking toward the flank.

**Treatment.**—Treatment naturally depends upon a proper diagnosis of the specific cause of the colic. Those forms which are most common and most amenable to treatment are benefited by giving stimulants and antispasmodics, such as sweet spirit of niter or turpentine, from one-quarter to one-half ounce, and purgatives, such as Epsom salt or castor oil, 4 ounces. After treatment should consist in proper regulation of feed and careful nursing.

**DIARRHEA**

(Dysentery)

**Cause.**—Common diarrhea, as distinguished from white scours of lambs and from diarrhea associated with specific diseases, is due to

disturbances in the digestive system from irritants in the feed, change to an abundance of succulent feed, spoiled feed, exposure after shearing, or to the presence of parasitic worms in the intestine.

**Treatment.**—The feed should be examined and regulated. Great care should be taken in moving the flock from scanty feed to richer or more abundant supplies. Adverse conditions in both feeding and stabling should be corrected. It is best to give a purgative, such as Epsom salt, 4 ounces, or castor or linseed oil, 4 ounces, to remove the irritating matter. If diarrhea persists, subnitrate of bismuth may be given in from one-half to 1 teaspoonful doses.

#### CONSTIPATION

**Cause.**—Constipation may be a symptom of certain stages of general diseases. Simple constipation is due to digestive disturbance resulting from indigestible, dry feed with insufficient water, wool balls, especially in lambs, or lack of exercise in stalled rams.

**Symptoms.**—The animal is dull, appetite is decreased, the mouth is dry, and sometimes colicky pains are evident. Attempts are made to defecate and the feces passed are hard and coated with mucus.

**Treatment.**—Grown sheep should be given 4 ounces of Epsom salt or Glauber salt in a quart of water. Lambs should be given a smaller quantity, according to size, or 2 ounces of castor or linseed oil. Succulent green feed should be fed for several days.

#### RETENTION OF THE MECONIUM

Retention of the meconium is observed in newborn lambs which fail to pass the dung soon after birth.

**Symptoms.**—There are evidences of colicky pains as a result of intestinal irritation.

**Treatment.**—Give an injection of linseed oil into the rectum, also a teaspoonful of castor oil by the mouth.

#### DISEASES OF THE NERVOUS SYSTEM

##### MENINGITIS

Meningitis is manifested by inflammation of the brain and spinal cord and their membranes. It is more often seen in lambs than in old sheep. Louping ill, a disease of sheep in the British Isles, is a form of meningitis.

**Cause.**—The exact cause is often obscure. The presence of micro-organisms or their toxins, however, is nearly always responsible. The blood stream may carry infection to the parts from wounds resulting from injuries, or from local areas of pus infection following the castration or docking of lambs. Other infectious diseases may extend to the brain or spinal cord. Parasitic cysts may set up meningitis.

**Symptoms.**—The symptoms shown are due to changes in the cells of the brain or spinal cord. These are mainly staggering gait, aimless rushing about, prostration, spasmodic or convulsive movements of the limbs, drawing of the head backward or to either side, and paralysis of one or all limbs or other parts of the body. The disease may last for several days, usually resulting in death.

**Post-mortem appearance.**—Congestion, pus areas, or exudates may be found at some point of the brain or cord, or they may not be visible to the naked eye. Other diseased conditions of the body which have led to meningitis may be observed.

**Treatment.**—Treatment is futile. The practice of antiseptic measures in docking and castrating will do much to prevent infection from these sources.

#### PARALYSIS

Paralysis is a loss of motion or sensation in a part of the body and generally depends upon brain or nerve derangement. Commonly, however, the term is used to express lack of movement, whether due to absence of nerve control, to extreme weakness, or to disinclination to move as a result of pain.

**Cause.**—True paralysis in the sheep is present in the late stages of rabies, in parturient paralysis or milk fever, in meningitis, and in gid. Conditions resembling paralysis are found in a number of the infectious and noninfectious diseases.

**Treatment.**—Treatment depends upon the cause and follows the lines indicated for the diseases with which it is associated.

### DISEASES OF THE URINARY SYSTEM

#### BLOODY URINE

(Hematuria)

**Cause.**—Reddish urine may be a symptom of several diseases, such as anthrax, hemorrhagic septicemia, icterohematuria, inflammation of the kidneys or bladder, and urinary calculi (stones). It may also follow the eating of frozen feed or poisonous plants.

**Treatment.**—The conditions which cause a reddening of the urine should be discovered, if possible, and treated.

#### UREMIA

In cases of uremia, toxic substances which should be excreted with the urine are retained in the blood.

**Cause.**—It usually depends on retention of urine in the bladder as a result of paralysis of the bladder in connection with other diseases or when urinary calculi are lodged in the urethra. Males are more subject to stoppage of the urethra with calculi and hence more often show uremia than females. Rupture of the bladder and diseases of the kidneys also cause the disease.

**Symptoms.**—In the early stages there are frequent attempts to pass urine. Later, in acute cases, there is staggering gait, dizziness, and stupor, leading to unconsciousness; there are also muscular tremors and uremic convulsions. The breath smells of urine. Meat of animals slaughtered when suffering from uremia has a urinous odor.

**Treatment.**—The urine should be withdrawn by means of a small catheter, or, in the case of males, urinary calculi should be removed by cutting off the S-shaped tube at the end of the penis, in which the calculi are generally lodged.

#### GRAVEL

(Urinary calculi)

**Cause.**—Rams and wethers suffer from obstruction of the urinary passage with small bodies made up of mineral salts. Extensive feeding on turnips, sugar beets, or mangels, or feeds rich in lime salts, cause urinary calculi.

**Symptoms.**—The common symptoms are restlessness and frequent straining to urinate, also distention of the bladder, shown by swelling of the belly (water belly). The calculi are usually near the end of the penis, which is partly protruded.

**Treatment.**—The S-shaped, free end of the urethra at the end of the penis may be amputated to remove the calculi and to allow the urine to flow freely. If the obstruction is further back, a more difficult operation is necessary.

#### DISEASES OF THE REPRODUCTIVE SYSTEM ABORTION

**Cause.**—Abortion in ewes may be due to a variety of causes. It may result when the animal is affected with a febrile disease; from feed containing molds, such as ergot; from being frightened or run by dogs; or from rough handling or injury. It apparently occurs also in some flocks as a specific infection due to abortion-producing microorganisms.

**Symptoms.**—The animal about to abort is restless, bleats constantly, and has an offensive, glairy discharge from the vagina. The lamb is usually expelled dead or dies in a short time. A portion of afterbirth may hang from the genital opening. In infectious abortion the ewe has a severe diarrhea, a putrid, dark discharge from the vagina, and a necrotic afterbirth hanging from the vulva.

**Treatment.**—When several cases occur about the same time and no evidence of disease or injury is apparent the feed should be examined or changed. The genital passages may be washed out with compound solution of cresol in one-fourth of 1 per cent solution, or carbolic acid in 1 per cent solution daily until the discharge ceases. Retained afterbirth should be removed if it does not come away in a day or two. The hand, instrument, and genital parts should be well disinfected before removal is attempted. Where abortions in the flock occur frequently and symptoms suggest infectious abortion, all aborting animals should be removed and the fetuses and afterbirths destroyed. Liming the soiled areas or disinfection of pens is of great importance in preventing the spread of infection.

#### DEATH OF FETUS IN WOMB

Death of the fetus in the womb may be manifested by metritis (inflammation of the womb) accompanied with a purulent discharge, or no external symptoms may be shown, and the fetus dries up or becomes mummified. In the former case the treatment as given for metritis is indicated. In the latter case the udder is milked out to guard against mammitis and the animal is fattened for slaughter.

#### EVERSION OF UTERUS AND VAGINA

**Causes.**—Protrusion of the genital organs through the vulva may result from violent spasms of the uterus, severe straining, or from forcible extraction of the lamb.

**Treatment.**—The parts should be thoroughly cleaned, washed with a 2 per cent carbolic-acid solution, and, after the fetal membranes are removed, gently forced back through the vagina. Sutures through the skin on each side of the vulva and passing over the opening will prevent a recurrence. If badly inflamed or gangrenous, the parts may be removed by proper surgical methods.

**DYSTOCIA**

(Difficult lambing)

The condition known as dystocia should be handled by a veterinarian or one thoroughly acquainted with the anatomy of the genital organs and the various positions which fetuses assume in presentation for birth. It is seen most frequently in ewes when they lamb for the first time. Parts of each of twin lambs entering the pelvic cavity at the same time are often responsible. When the head or legs are not presented in a normal manner or when the fetus is malformed dystocia is evident.

**Treatment.**—The ewe should be held and her genital passage and the hand of the operator lubricated with linseed oil. The fetus is pushed back into the uterus and rotated into position for normal presentation. A cord is passed over the feet, either fore or hind, according to the position of the fetus, and moderate traction applied as an aid to the efforts of the ewe. In assisting the ewe to pass the lamb care should be taken to see that the hands and instruments are disinfected and that no injury is done to the genital passage.

**METRITIS**

(Inflammation of the womb)

Inflammation of the generative organs of the ewe is nearly always of the septic form, runs a rapid course, and is generally fatal.

**Cause.**—It may occur after abortion or after normal birth, but usually follows difficult labor and forcible removal of the fetus. Injuries or tears of the uterus or vagina become infected by micro-organisms and a septic condition is set up. Retained afterbirth or a dead fetus in the womb decomposes and sets up metritis.

**Symptoms.**—The ewe shows weakness, prostration, and distention of the rumen. There is frequent straining and a discharge from the vagina. If the animal survives the acute form, a chronic discharge may continue. Ascites (abdominal dropsy) is often present.

**Treatment.**—Treatment of septic metritis is not satisfactory. Early flushing of the uterus with mild antiseptics, such as hydrogen peroxide (5 per cent) or carbolic acid (1 per cent) is very important. A retained membrane or fetus should be removed by a veterinarian. Since infection may be carried from an infected to a healthy ewe, the operator should disinfect himself and instruments well before handling another animal.

**PREPARTURIENT PARALYSIS**

(Before-lambing paralysis, or preparturient anemia)

The disease known as preparturient paralysis occurs in pregnant ewes shortly before lambing. It is often seen in sheep on farms where high feeding and failure to give the ewes space enough for exercise before parturition bring on excessive fatness. It has also been observed among aged range ewes that have been removed from good pasture and closely housed, being given a ration of hay alone for a few days before their parturition.

**Cause.**—Too much rich or concentrated feed, without exercise enough to use up the excessive accumulation of food material in the body and stimulate the throwing off of poisonous body products, predisposes vigorous animals to preparturient paralysis. In the case of

aged range ewes similar symptoms seem to be produced by anemia arising from lack of sufficient nourishment. Heavy twin lambs are often responsible for the condition.

**Symptoms.**—In the most violent cases the ewe, without showing any earlier symptoms, falls insensible and dies in a short time with or without convulsions. In the more common form, which may last four or five days or longer, there is first seen twitching of the muscles of the hind parts and ears, loss of appetite, weakness, staggering gait, stupor, and a dark discharge from the vagina. Lambing may take place and the animal may recover, followed by the shedding of wool. In other cases severe prostration is observed, the lamb may be expelled dead, the ewe becomes completely insensible, and death follows.

**Treatment.**—Proper feeding and provision for exercise for some time before the lambing period will guard against this condition. Affected ewes should be given 6 ounces of Epsom salt as soon as symptoms are noticed, or if the animal is not too weak, from 5 to 10 drops of croton oil in a tablespoonful of linseed oil. Stimulants, such as strong coffee, may be given frequently. It has been reported that the disease as it occurs among aged range ewes may be prevented by giving the flock of breeding animals a daily feed of grain in addition to their hay ration and at the same time allowing them full opportunity for exercise.

#### MILK FEVER OF EWES

(After-lambing paralysis, eclampsia)

Milk fever of ewes is characterized by paralysis shortly after lambing.

**Cause.**—The cause of milk fever is not known, but it is thought to be due to toxins which develop in the udders of animals which are heavily fed and show heavy milk production at the time of lambing.

**Symptoms.**—Within a day or two after giving birth the ewe shows a loss of appetite, restlessness, weakness, and falls to the ground, lying in a comatose condition as if paralyzed. In favorable cases recovery takes place rapidly. In unfavorable cases death may follow in a short time. The disease is sometimes brought on by the death of the lamb or by its being taken away from the mother.

**Treatment.**—The injection of air into the udder through the teats effects a cure. This may be done by means of a syringe, or by a hard-rubber bulb applied over the opening in the teat.

#### MAMMITIS

(Blue bag, garget, caked udder)

Mammitis is an inflammatory disease of the udder and is frequent in ewes suckling young. It may occur in a mild or in a gangrenous form.

**Cause.**—It is generally due to the action of microorganisms which multiply in the milk and tissues of the udder and set up inflammatory changes. Secondary influences, such as injuries, the loss of the young with consequent accumulation of milk in the udder, or systemic derangements favor the development of disease germs.

**Symptoms.**—One-half of the udder or the whole udder may be affected. The part is hot, swollen, and doughy, or hard. There is restlessness and pain when suckled. The milk secretion becomes

thick, yellowish, and at times bloodstained. Gangrene of the udder, with bluish discoloration, may ensue.

**Treatment.**—The animal should be removed from the flock. The udder should be milked frequently and hot applications made; also the part should be rubbed well or massaged. Turpentine lini-  
ment or tincture of iodine may be applied. Badly abscessed udders may be lanced, or the udder may be removed by a veterinarian. Animals which recover are usually fattened for slaughter.

#### REVIVING CHILLED LAMBS

In case of twins the first born may become chilled before the ewe has time to lick it dry or suckle it. Newborn lambs frequently become chilled through inattention in cold weather.

Comfortable lambing barns should be provided. Chilled lambs may be placed in warm quarters, wrapped in blankets, or the body may be immersed in a tub of warm water. When revived the lamb is wiped dry and given to its mother or held at her side until it has suckled.

#### DISEASES OF THE SKIN

##### ECZEMA

(Rain rot, greasy heel)

Eczema is a disease of the skin characterized by congestion, exudation, and itching.

**Cause.**—The most important form of eczema is found in loose-wooled sheep and affects principally the back, loins, and croup. It results when the animal gets wet to the skin in cold, damp weather. Continuous dampness of the skin sets up an inflammation. This condition is known as fat scab or rain rot.

Greasy heel occurring on the fetlocks, and eczema between the claws, are seen in sheep kept in damp or dirty places.

Solar eczema results from exposure to the sun soon after shearing.

Irritants on the skin, such as strong sheep dips, may cause eczema.

**Symptoms.**—The skin is swollen, cracked in spots, reddened, and covered with a moist exudate which dries and forms scabs. Itching is present. Patches of wool fall out.

**Treatment.**—Recovery takes place in a short time when the conditions which bring on eczema are removed. Rain rot disappears in dry weather.

##### RINGWORM

Ringworm is an infectious skin disease which, in sheep, is not very often seen in the United States.

**Cause.**—It is caused by a fungus, *Trichophyton tonsurans*, which grows around the roots of the wool and forms an enormous number of spores (seeds). The disease when once in a flock may be transferred from one animal to another by direct contact or by rubbing posts.

**Symptoms.**—Small, circular spots covered by a grayish-white crust appear on the back, neck, face, chest, or shoulder. They may be detected by the matting of the wool into small tufts which stand out prominently. Itching is severe and the animal rubs the affected parts. The skin is reddened. Ringworm areas may extend, unite, and lead to baldness.

**Treatment.**—Diseased animals should be isolated as soon as symptoms are noticed, and pens or rubbing places should be disinfected. Shear the affected regions. Soften the ringworm crusts with the aid of soft soap or an oily substance and remove them. Apply an ointment of cresol or carbolic acid 1 part and lanolin or vaseline 10 parts; tincture of iodine may be substituted. Applications should be repeated daily until healing is effected.

#### BUCKWHEAT RASH

(Fagopyrism)

A mild or severe inflammation of the skin of white sheep is associated with the feeding of buckwheat and exposure to direct sunlight. Black sheep or black areas on white sheep are not affected. This disease is reported from Europe but closely resembles bighead in American sheep.

**Cause.**—The green flowering buckwheat plant is more active than either the grain or dried plant. Exposure to direct sunlight within a few days after eating buckwheat is necessary to production of the rash.

**Symptoms.**—In mild cases the skin is reddened, slightly swollen, and itches. Recovery takes place in a day or two, leaving a brownish discoloration of the skin.

In severe cases the affected skin is deeply reddened, considerably swollen, and the itching is intense. Vesicles form, rupture, and leave crusts. The head may be badly swollen, ears drooping. The animal runs about wildly. In fatal cases death occurs after 10 or 12 hours. Otherwise the animal recovers within a few days.

**Treatment.**—Give from 2 to 4 ounces of castor oil. Stop feeding buckwheat. Keep the animals under cover or in a shady place for a few days when the sun's rays are intense. Olive oil, cottonseed oil, or vaseline should be rubbed over the affected areas.

#### DANDRUFF

(False scab, tallow scab)

Whitish-yellow or brownish-yellow, greasy scales may be observed on the back, shoulders, breast, or neck. The scales consist of oily secretion and cells of the outer layer of the skin. Itching is absent, but the animal may pull wool from the affected areas.

**Cause.**—Frequently no cause is apparent, but animals in poor condition or suffering from other ailments are most often affected.

**Treatment.**—The disease is not of common occurrence and is of small importance. Good nourishment and care of the skin generally correct the disorder.

#### BALDNESS

(Alopecia, falling out of the wool)

Baldness is observed as a symptom or as a result of several diseases, namely, scab, blue bag, metritis, eczema, ringworm, dandruff, or any disease accompanied with severe fever. Its control rests upon the proper treatment of the disease from which it results.